



Multi-Purpose Crew Vehicle Program Update

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Orion Exploration Flight Test 1 (EFT-1)



EFT-1 Program Schedule Update



- ▶ Underway Recovery Test 2 (URT2) [August 4–7, 2014]
COMPLETED
 - USS Anchorage, off the coast of San Clemente.
 - Most primary test objectives were met.
 - Limited SMG involvement. Tested communication procedures with Sasquatch program operator on board ship.
 - ▶ Underway Recovery Test 4a (URT4a) [September 12–15, 2014]
 - Objective: To demonstrate crane-lift operations using a supsalv ship.
 - ▶ Underway Recovery Test 3 (URT3) [September 15–19, 2014]
 - Using well-deck operations and full mission dress rehearsal.
 - Weather support similar to URT1 conducted in February 2014.
 - Daily weather balloons and surface weather/wave observations.
 - Full End-to-End simulation with Flight Control Team on Sept. 18.
 - Day-of-Launch balloon schedule and transmission to shipboard users and MCC/SMG.
- *NOTE: Orion test article will remain at sea between URT4a and URT3.



EFT-1 Program Schedule Update (cont'd)



- ▶ Crew Exploration Vehicle (CEV) Parachute Assembly System (CPAS) testing continues at Yuma Proving Ground in Arizona leading up to EFT-1.
 - CPAS Drop Test (CDT) 3-15 is NET November 19 & 20, 2014.
- ▶ Joint Integrated Simulation 2 (JIS 2) [September 9, 2014]
 - High fidelity training simulation featuring Mission Management Team, Test & Launch Control Center, Flight Control Team, and the Engineering Support Room.
 - Focus will be on pre-launch activities.
 - Pickup at L-6 hours
 - End at Liftoff
 - JIS 1 conducted in late May 2014.
 - Pre-launch through Splashdown + 1 hour
- ▶ Additional simulations TBD.
- ▶ **EFT-1 launch date: December 4, 2014.**

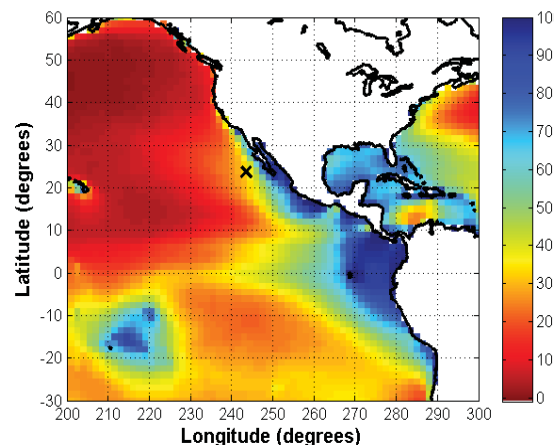


Support for EFT-1 Activities: Natural Environments Branch



- ▶ Due to the slip of EFT-1 to December 2014, there is concern about the wintertime sea conditions in the EFT-1 landing zone.
 - Based on the nominal sea state landing criteria, the landing probabilities around the EFT-1 zone are significantly lower during the December launch window.
 - The Natural Environments (NE) Branch has been performing several sea state analyses to understand the likelihood and driving conditions of these lower probabilities.
 - Biggest concern relates to launch availability and the capability of the recovery forces.
 - Along with SMG, NE Branch has been providing URT guidance so that the ships can test in conditions most likely to be encountered during EFT-1.

December Nominal Sea Condition Probabilities





Support for EFT-1 Activities: SMG



- ▶ CPAS Test Support:
 - Provide upper wind forecasts to CDT 3-15 test in November.
 - Other analysis support in coordination with MSFC Nat. Env.
- ▶ Cloud cover and in-flight winds climatology for NASA SCIFLI (Scientifically Calibrated In-Flight Imagery) project.
- ▶ High resolution and thermal imaging of Orion re-entry and splashdown.
 - “Peak Heating” aircraft well uptrack.
 - “Imaging” aircraft near EFT-1 splashdown.
- ▶ SMG will provide launch/splashdown day forecast support to SCIFLI team to help position the two P3 Orion aircraft imaging the mission.
 - Cloud coverage and general viewing conditions for aircraft imaging.
 - In-flight winds.
- ▶ Day of launch forecasts to JSC Flight Control Team:
 - Surface & upper winds (for heading alignment input, trajectory input, Sasquatch debris footprint modeling, etc.).
 - Ocean significant wave height, wave period, and other wave elements (capsule recovery).
 - Other routine weather elements (temperature, pressure, visibility, sensible weather, cloud cover, etc.).



SMG EFT-1 Forward Work



- ▶ Upper winds forecast accuracy for EFT-1 site.
- ▶ Ingest of new weather and wave forecast model data.



Exploration Missions 1 & 2 (EM1 / EM2)



Orion EM Program Milestones



- ▶ European Service Module Preliminary Design Review (PDR).
 - Completed April–May, 2014.
- ▶ Orion delta PDR (dPDR).
 - Completed June – August, 2014.
 - Several environment–related Requests For Action (RFAs).
 - Forward work to be completed as part of the discussions and RFA close–outs.
- ▶ Orion Critical Design Review (CDR) expected to occur August 2015.



Orion dPDR Forward Work



- ▶ Coming out of the Orion dPDR, the following natural environment analyses and support are expected to be performed between now and Orion CDR:
 - Aloft wind shear analysis in support of CPAS performance studies.
 - Pad and near-pad abort winds analysis in support of potential blow-back-toward-land/pad and CPAS performance studies.
 - Assessment of the water depth off the coast of KSC in support of Orion protecting for a 10-foot water landing depth during a pad abort scenario.
 - Updated sea state analysis of the EM nominal landing zone off the coast of San Diego.
 - Ocean sea state probabilities to support alternate water landing site discussions.



Other Orion EM Forward Work



- ▶ Continue to support Landing & Recovery testing and analyses.
- ▶ Support development of integrated Operations & Maintenance Requirements (OMRs).
- ▶ Support Orion EDL/GN&C EM Design Analysis Cycle work.
 - Additional natural environment analyses are expected as Orion moves toward EM flights and nominal landings off the coast of San Diego.
- ▶ Support Orion launch/landing analyses.
 - Terrestrial environments will affect launch availability, landing availability, pad aborts.
- ▶ Support Orion Weather Flight Rule development for EM missions.
 - Instrumentation such as offshore buoys and 915 MHz Doppler Radar Wind Profiler may be necessary to support flight rules.